

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005

REMARKS AND ARGUMENTS

The present application includes claims 1-40. Claims 1-40 were rejected in the September 29, 2005 Office Action. By this Amendment, claims 1, 10, 20, 30 and 37 are amended and claims 2, 11, 21 and 31 are canceled. In addition, paragraphs 19, 39, 41, 44, 46 and 52 of the specification are amended to correct typographical errors. Paragraph 1 of the specification is amended to provide the Provisional Application serial number to which the present application claims benefit of and priority from. No new matter is added by any of these amendments.

Claims 1-40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chiao et al. (U.S. Patent No. 6,375,618), further in view of Phillips et al. (U.S. Patent No. 6,241,674).

Claims 1, 10, 20, 30 and 37 are amended to recite decoding backscattered echo(es) of coded pulse(s) and backscattered echo(es) of phase inverted version(s) of the coded pulse(s), where the decoding occurs naturally through (A) propagation of at least the coded pulse(s) and the phase inverted version(s) of the coded pulse(s) inside tissue and (B) the coherent summation of the backscattered echo(es) of the coded pulse(s) with the backscattered echo(es) of the phase inverted version(s) of the coded pulse(s).

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005

The Applicant now turns to the rejection of claims 1-40 under 35 U.S.C. § 103(a) as being unpatentable over Chiao in view of Phillips. Chiao describes enhanced tissue-generated harmonic imaging using coded excitation. (Chiao at Title.) Specifically, Chiao describes improving the harmonic-to-fundamental ratio (“HFR”) and harmonic-to-noise ratio (“HNR”) of tissue-generated harmonic imaging using coded excitation by transmitting a long encoded pulse sequence and decoding the received beamsummed data. (*Id.* at col. 3, lines 20-24.) The amplitude of the transmitted pulse sequence is sufficiently high so as to create harmonic signals from the tissue nonlinearity. (*Id.* at col. 3, lines 25-27.) The fundamental and harmonic signals are received, beamformed, isolated and decoded, and used to form an image. (*Id.* at col. 3, lines 27-30.) The transmit waveform for acquiring the Nth harmonic signal is biphas (1,-1) encoded using two code symbols of a code sequence, with each encoded portion (that is, chip) of the transmit waveform encoded with the second code symbol being phase-shifted by $180^\circ/N$ relative to the chips encoded with the first code symbol. (*Id.* at col. 3, lines 30-36.) During reception, a second harmonic signal is isolated by a bandpass filter centered at twice the fundamental frequency and enhanced with decoding. (*Id.* at col. 3, lines 46-49.) Chiao states that the bandpass filtering and decoding functions are preferably combined in one filter. (*Id.* at col. 3, lines 49-50.)

According to Chiao, as only the second harmonic signal is properly matched to the decoding filter, the fundamental (and other harmonic signals) signal are not properly

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005

encoded and therefore do not achieve any decoding gain. (*Id.* at col. 3, lines 51-54.)

Chiao asserts that this causes HFR and HNR to be increased. (*Id.* at col. 3, lines 51-60.)

Chiao only discloses decoding of received signals using one of three decoding filters: (1) an enhanced bandpass filter, or “decoding filter” or “composite filter 46” of FIG. 7 (*id.* at col. 3, lines 46-56, col. 6, lines 36-38, col. 7, lines 16-23 and 53-55), (2) a decoding finite impulse response (“FIR”) filter separate from a bandpass FIR filter (*id.* at col. 7, lines 21-23, col. 8, lines 1-6 and 11-16), or (3) a decoding filter comprising an FIR filter and a vector summer. (*Id.* at col. 8, lines 31-45.)

Chiao does not teach or suggest naturally decoding backscattered echoes of a coded pulse and a phase inverted version of the coded pulse through (A) propagation of at least the coded pulse and phase inverted version of the coded pulse inside tissue and (B) the coherent summation of the backscattered echo of the coded pulse with the backscattered echo of the phase inverted version of the coded pulse, as recited in claims 1, 10, 20, 30 and 37. Rather, as described above, Chiao only describes decoding received signals using one of three decoding filters. (*Id.* at col. 3, lines 46-56, col. 6, lines 36-38, col. 7, lines 16-23 and 53-55, col. 8, lines 1-6, 11-16, and 31-45.) Chiao does not teach or suggest any other decoding of received signals other than through one of these three decoding filters. Therefore, Chiao does not teach or suggest elements of at least claims 1, 10, 20, 30 and 37.

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005

Phillips describes a medical ultrasound diagnostic imaging method and system with nonlinear phase modulation pulse compression. (Phillips at Title.) However, Phillips does not remedy the shortcomings of Chiao, for example as described above. That is, Phillips also does not teach or suggest naturally decoding backscattered echoes of a coded pulse and a phase inverted version of the coded pulse through (A) propagation of at least the coded pulse and phase inverted version of the coded pulse inside tissue and (B) the coherent summation of the backscattered echo of the coded pulse with the backscattered echo of the phase inverted version of the coded pulse, as recited in claims 1, 10, 20, 30 and 37. Rather, Phillips describes decoding of received signals using a decoding receiver 22 or a pulse-compression filter. (*Id.* at col. 3, line 67 - col. 4, lines 1-3, col. 9, lines 41-42.) For example, Phillips describes several decoding receive baseband filters, such as those depicted in Figures 4a-c and 8a-c. (*See also id.* at col. 8, lines 28-43.) Phillips also describes decoding using the pulse-compression receiver at col. 12, lines 11-14.) However, Phillips does not teach or suggest any type of natural decoding as recited in claims 1, 10, 20, 30 and 37. Therefore, like Chiao, Phillips also does not teach or suggest elements of at least these claims.

Moreover, assuming for the sake of argument that one would be motivated to combine Chiao and Phillips, the combination of the two also does not teach or suggest elements of claims 1, 10, 20, 30 and 37. As described above, neither Chiao nor Phillips,

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005

taken alone or in combination, teaches or suggests any type of natural decoding as recited in these claims.

The present rejection encompasses claims 1-40. As described above, neither Chiao nor Phillips, taken alone or in combination, teaches or suggests elements of at least independent claims 1, 10, 20, 30 and 37. Claims 3-9, 12-19, 22-29, 32-36 and 38-40 depend from independent claims 1, 10, 20, 30 and 37. Therefore, claims 1, 3-10, 12-20, 22-30 and 32-40 should be allowable.

The Applicant respectfully submits that the claims of the present application should be allowable over the prior art.

Application No. 10/679,542
Attorney Docket No. 137741UL
Amendment dated November 21, 2005
Reply to Office Action of September 29, 2005


CONCLUSION

If the Examiner has any questions or the Applicant can be of any assistance, the Examiner is invited and encouraged to contact the Applicant at the number below.

The Commissioner is authorized to charge any necessary fees or credit any overpayment to the Deposit Account of GTC, Account No. 07-0845.

Respectfully submitted,

Date: November 21, 2005



Christopher R. Carroll
Registration No. 52,700

MCANDREWS, HELD & MALLOY, LTD.
500 West Madison Street, 34th Floor
Chicago, IL 60661

Telephone: (312) 775-8000
Facsimile: (312) 775-8100